

SCIENCE, AERONAUTICS AND TECHNOLOGY

FISCAL YEAR 2000 ESTIMATES

BUDGET SUMMARY

ACADEMIC PROGRAMS

MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAM

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 1998</u> <u>OPLAN</u> <u>9/29/98</u>	<u>FY 1999</u> <u>OPLAN</u> <u>12/22/98</u>	<u>FY 2000</u> <u>PRES</u> <u>BUDGET</u>	<u>Page</u> <u>Number</u>
	(Thousands of Dollars)			
Historically Black Colleges and Universities	<u>30,000</u>	<u>36,200</u>	<u>28,000</u>	SAT 6.2-10
University Research Center Awards	200	--	--	
Institutional Research Awards	--	1,000	3,200	
Principal Investigator Awards	4,600	5,200	4,500	
Math and Science Education Awards	16,200	14,500	18,500	
Partnership Awards	9,000	15,500	1,800	
Enterprise Program Funding *	[12,800]	[17,100]	[17,100]	
Other Minority Universities	<u>23,200</u>	<u>30,700</u>	<u>17,900</u>	SAT 6.2-15
Institutional Research Awards	2,000	500	1,500	
Principal Investigator Awards	2,500	3,100	3,600	
Math and Science Education Awards	15,000	18,500	11,700	
Partnership Awards	3,700	8,600	1,100	
Enterprise Program Funding *	[8,000]	[11,700]	[11,700]	
Total Minority University Research Programs	<u>53,200</u>	<u>66,900</u>	<u>45,900</u>	
Total Enterprise Program Funding *	<u>[20,800]</u>	<u>[28,800]</u>	<u>[28,800]</u>	
Total Program Funding to Minority University Research ...	<u>74,000</u>	<u>95,700</u>	<u>74,700</u>	

* Represents funding included in Enterprise budget request in support of Minority University Programs

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MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAM

FY 1998 FY 1999 FY 2000

(Thousands of Dollars)

Distribution of Program Amount by Installation

Johnson Space Center	2,500	2,900	2,200
Kennedy Space Center	4,100	5,700	4,300
Marshall Space Flight Center	8,700	5,700	4,900
Stennis Space Center	1,500	3,200	2,600
Ames Research Center	700	2,500	1,900
Dryden Flight Research Center	1,500	3,100	2,300
Langley Research Center	2,700	5,400	4,300
Glenn Research Center	7,600	13,300	2,100
Goddard Space Flight Center	21,700	22,100	18,700
Jet Propulsion Laboratory	1,400	3,000	2,600
Headquarters	<u>800</u>	<u>--</u>	<u>--</u>
Total	<u>53,200</u>	<u>66,900</u>	<u>45,900</u>

SCIENCE, AERONAUTICS AND TECHNOLOGY

FISCAL YEAR 2000 ESTIMATES

BUDGET SUMMARY

ACADEMIC PROGRAMS

MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAM

PROGRAM GOALS

The Minority University Research and Education Programs (MUREP) focus primarily on expanding and advancing NASA's scientific and technological base through collaborative efforts with Historically Black Colleges and Universities (HBCU) and Other Minority Universities (OMU), including Hispanic-Serving Institutions (HSI) and Tribal Colleges and Universities (TCU), hereafter referred to as Minority Institutions (MI). NASA's outreach to MI's in FY 2000 will build upon the prior years' investments in MI research and academic infrastructure. Through sufficient infrastructure-building support, exposure to NASA's unique mission and facilities, and involvement in competitive peer review and merit selection processes annually, MI's will be able to contribute significantly to the Agency's strategic goals and objectives. These contributions include the education of a more diverse resource pool of scientific and technical personnel who will be well prepared to confront technological challenges for the benefit of NASA and the Nation. In addition to the Federal mandates for MI's, the strategic goals that guide NASA's MUREP are: (1) To foster research and development activities at MI's which contribute substantially to NASA's mission; (2) To create systemic and sustainable change at MI's through partnerships and programs that enhance research and educational outcomes in NASA-related fields; (3) To prepare faculty and students at MI's to successfully participate in the conventional, competitive research and education process; and (4) To increase the number of students served by MI's to enter college and successfully pursue and complete degrees in NASA-related fields.

STRATEGY FOR ACHIEVING GOALS

NASA employs a comprehensive and complementary array of strategies to achieve these goals for MI's. These strategies include: (1) Working closely with NASA Strategic Enterprises, other government agencies, and interested parties to develop new research and education collaborations and partnerships; (2) Encouraging and providing opportunities for faculty to conduct NASA research early in their careers; (3) Providing incentives for students to enter and remain in mathematics, science and technology disciplines; (4) Establishing measurable program goals and objectives; and (5) Developing and implementing evaluations to assess the effectiveness and outcomes of the programs and financial performance, and thereby improving program delivery and results.

A strategy used to expand MI involvement in competitive peer review processes and to ensure the relevance of research conducted by MI's is to involve NASA Strategic Enterprises early in the development of solicitation notices. Once Headquarters issues the notices, NASA Centers provide advice to prospective grantees, conduct peer reviews of proposals, and provide funding

recommendations to the Office of Equal Opportunity Programs (OEOP) and the Strategic Enterprises. After Headquarters makes the selections, the research is returned to the nominating NASA Center(s) or Jet Propulsion Laboratory (JPL) for grant award and technical management of the award. OEOP provides policy direction and program oversight. Oversight of the research performed at MI's is conducted by the Strategic Enterprises in collaboration with OEOP. In addition, all MUREP requests for continuation funding are assessed for performance by the NASA Technical Officers and all awards funded for more than 2 years receive on-site reviews.

The successful deployment of these strategies has resulted in the establishment of five different programmatic award categories which apply equally to the HBCU and OMU MI Programs. These award categories are: (1) University Research Centers (URC) Awards; (2) Institutional Research Awards (IRA); Principal Investigators (PI) Awards; (4) Mathematics and Science Education (MSE) Awards; and (5) Partnership Awards.

University Research Center (URC) Awards

University Research Center (URC) Awards achieve a broad-based, competitive aerospace research capability among the Nation's MI's that will: foster new aerospace science and technology concepts; expand the Nation's base for aerospace research and development; develop mechanisms for increased participation by faculty and students in mainstream research; and increase the productivity of students (who are U.S. citizens and who have historically been underrepresented) with advanced degrees in NASA-related fields. Funding is provided by the Strategic Enterprises. In order to foster closer ties between the URC's and NASA, a Lead NASA Center is designated for each URC that is responsible for directly managing the URC cooperative agreements, and for increasing MI involvement in ongoing NASA research and development activities. Collaborations with other NASA Centers, industry, and other universities are strongly encouraged. OEOP continues to maintain responsibility for program policy and oversight. The URC's have formed a National Alliance of NASA University Research Centers (NANURC). This Alliance has established a National Conference of the University Research Centers, created pathways for developing greater collaborations between the URC's, and is exploring avenues for increasing the number of advanced degrees being awarded to disadvantaged students. NASA is strongly supportive of this concept and is actively working with the Alliance to further develop and strengthen their organization.

Institutional Research Awards (IRA)

Institutional Research Awards (IRA) improve academic, scientific and technology infrastructure and broaden the NASA-related science and technology base at MI's. Two awards with different focus areas have been made under this category. The first IRA (Research) award was made in FY 1994 and was limited to only OMU's. These awards provide OMU's with an opportunity to provide a quality learning and research environment in NASA-related areas. The second IRA (Network Resources and Training Sites [NRTS]) were open to all MI's. The IRA (NRTS) award is designed to improve the in-house capability to electronically access science data and computational resources; to develop mechanisms to support, sustain and evolve the network infrastructure of the targeted universities and colleges; and to make MI's more effective in the competitive process for NASA and other science, engineering and technology funding opportunities. IRA awards provide for the acquisition of research equipment and equipment essential to Internet connectivity. The strategies for achieving the IRA (NRTS) goals include: (1) Establishing lead NRTS's (2)

Holding them accountable for providing internet connectivity to other MI's and public schools; and (3) For training students, faculty and teachers to build computers, maintain and effectively utilize the Internet to compliment teaching and research collaborations and delivery. Goddard Space Flight Center (GSFC), manages the IRA (NRTS) under the auspices of GSFC's Minority University - Space Interdisciplinary Network (MU-SPIN) Program. The Offices of Equal Opportunity Programs (OEOP), Space Science, and Earth Science collaboratively provide funding and oversight for the GSFC MU-SPIN Program. NASA Strategic Enterprises, NASA Centers, and JPL support IRA programs through direct funding, use of their facilities, and commitment of their personnel to serve on Technical Review Committees (TRC) and assisting in other facets of program implementation. Students and principal investigators involved in IRA (NRTS) spend time on-site at the Centers and JPL throughout the year.

Principal Investigators (PI) Awards

Principal Investigators (PI) Awards provide faculty with limited NASA experience, an opportunity to integrate the research and education components of their careers with the unique mission requirements of a specific NASA Center or JPL. Each fiscal year, MI's are invited to submit proposals for the Faculty Awards for Research (FAR). The FAR program provides for competitive, peer review selection of outstanding and promising engineering, physical and life science-tenured and tenure-track faculty who are capable of contributing to the Agency's research and education objectives. This award provides faculty members with research support and exposure to the NASA peer review process to enable them to demonstrate creativity, productivity, and future promise in the transition toward achieving competitive awards in the Agency's mainstream research processes. In FY 1996, these awards were expanded to include funding to involve graduate and undergraduate students in research projects.

The primary strategy for implementing the PI Awards for Research is through a competitive peer review and merit selection process in collaboration with the Strategic Enterprises, NASA Centers and JPL. Other strategies include: (1) Have discipline-related personnel at Headquarters and the NASA Centers and JPL be responsible for serving as points-of-contact for faculty interested in pursuing an award in this category; (2) Place responsibility on the interested NASA Centers or JPL for conducting the technical evaluations and making recommendations to Headquarters for funding consideration; (3) Provide funding to the nominating NASA Center or JPL to make PI Awards for Research; and (4) Hold the NASA Center or JPL responsible for managing the awards and research outcomes. By involving MI faculty and students in NASA research, the Agency hopes to increase the interest of traditionally underrepresented communities in the Agency's mission and involve a broader array of America's citizenry in the NASA-sponsored research community.

Mathematics and Science Education (MSE) Awards

Mathematics and Science Education (MSE) Awards build upon these institutions' outstanding ability to provide excellence in mathematics, science, engineering and technology (MSET) training while increasing the participation and achievement of socially and economically disadvantaged and disabled students in MSET fields at all levels of education. Awards are made in the following three areas: undergraduate and graduate; teacher preparation and enhancement; and precollege activities. MSE Awards contribute to the national education goals by integrating the contents from the NASA mission into the educational outreach projects at MI's. As a result, NASA contributes to an increase in the number and strengthens the skills, knowledge, and interest of students and teachers in mathematics-, science-, engineering-, and technology-based (MSET) academic programs.

MSE awards consist of both unsolicited and solicited awards. The solicited awards are the NASA Precollege Awards for Excellence in Mathematics, Science, Engineering and Technology (PACE/MSET) Program and the Mathematics, Science, and Technology Awards for Teacher and Curriculum Enhancement Program (MASTAP). Both types of MSE awards are reflected in the following subcategories:

- Undergraduate and Graduate Awards provide scholarships, fellowships, internships, and research opportunities in NASA-related fields, and other services to enhance retention and increase graduation rates. These awards respond to congressional direction to increase the number of individuals from underrepresented groups in the pool of graduate researchers. Students must be U.S. citizens and must pursue degrees in NASA-related fields. During the academic year and/or summer, students are required to conduct research relevant to their fields of study at a NASA Center, on a university campus, at a Federal laboratory or in the aerospace industry. It is expected that these students will form part of the pool from which NASA selects graduate researchers and/or employees.
- Teacher Preparation and Enhancement Awards provide opportunities for MI's to develop diverse and exemplary research-based mathematics, science, technology and geography teacher education curricula, integrated with content from NASA's mission. It is the Agency's desire that the results from these awards serve as models for other colleges and universities. Additionally, these awards will contribute to the participating states' efforts to increase the numbers and percentage of state-certified mathematics, science, technology or geography teachers employed in hard-to-staff elementary, middle and secondary schools not normally served by NASA.
- Precollege Awards provide opportunities for MI's, in collaboration with NASA and local school districts, to provide informal educational opportunities that will enhance the numbers and percentage of students enrolled in mathematics and science college preparatory courses. As a result of participating in these awards, students will gain awareness of career opportunities in MSET fields and exposure to NASA's mission and scientific and technical personnel role models.

Partnership Awards

Partnership Awards design to respond to congressional direction to "expand opportunities and enhance diversity in the NASA sponsored research and education community...achieve a balance between the proportion of NASA funding received by minority institutions of higher education and other institutions of higher education." The goals of the Partnership Awards program are to achieve the following outcomes: 1) More competitive undergraduate U.S. students with research training, who are exposed to NASA cutting-edge technology, and who are better prepared to enter MSET graduate programs or MSET careers; 2) Enhanced undergraduate courses and curriculum, including laboratory-based curricula that foster collaboration between NASA-funded research and education faculty; 3) Produce model HBCU's that integrate NASA-related research into appropriate areas of the undergraduate curriculum; and 4) to strengthen NASA Centers' and JPL's partnerships with OMU's through projects which are unique and innovative, which fall outside of the usual MUREP competitive programs, and which have high potential for long-term support from other sources. The NASA Centers and JPL are invited to jointly submit, with Presidents of Minority Universities, proposals in three different categories: research; education; or combination of the two to Headquarters for competitive review and

selection. All proposals selected for an award must be responsive to the Agency's strategic direction; the Federal mandates related to MI's; and the NASA MUREP goals. Additional funding of \$9.4M was included in the FY 1999 Appropriation Bill for VA-HUD-Independent Agencies to continue and expand the Partnership Award program and is divided between the HBCU and OMU programs.

All of the above programmatic initiatives are carried out in strong collaboration with NASA Strategic Enterprises, Centers and JPL. Strategic Enterprises, Centers, and JPL support the MUREP through direct funding, use of their facilities, and commitment of their personnel to serve on Technical Review Committees (TRC) and assist in other facets of program implementation. URC's and IRA's receive technical guidance and annual on-site reviews by TRC's. The PI, MSE, and Partnership Awards are managed predominately by personnel at the NASA Centers and JPL. As a result of the involvement of the Strategic Enterprises, NASA Centers and JPL in the MUREP, numerous students and PI's from MI's are knowledgeable about and make significant contributions to the Nation's space program.

In FY 2000, all five programmatic award categories will have activities to replace expiring awards with new competitive peer reviewed and selected awards. Outreach to MI's will continue to be made in collaboration with the Strategic Enterprises, Centers and JPL to ensure that MI's are knowledgeable of and responsive to the Agency's strategic plan. OEOP will continue to set specific program goals that lead to measurable program outcomes that are consistent with the Agency's investment in MI's.

SCHEDULE & OUTPUTS

MUREP metrics are continually being improved. Performance data measuring participation and program outcomes is obtained through the required submission of annual performance reports and/or on-site or reverse-site reviews of each award. Each grant recipient submits an annual performance report that is reviewed by a NASA Technical Monitor or a Technical Review Committee for qualitative and quantitative progress toward the project's and NASA's program goals and objectives. Continuous assessment of this data has enabled OEOP MUREP to identify performance measures for research and education awards. As part of the grantee's annual reporting requirements, each awardee is now being required to respond to a set of uniform research or education outcomes that enables OEOP to assess progress across all research or education awards. Additionally, as required by Executive Order 12876 for HBCU's and Executive Order 12900 for HSI's, at the end of each fiscal year, NASA measures its performance against the concluding fiscal year plan that was submitted to the White House Initiative Office and the Office of Management and Budget. The measures of performance include the number of awards and funding to HBCU's and HSI's in the following categories: research and development; program evaluation; training; facilities and equipment; fellowships, internships, traineeships, recruitment and IPA's; student tuition assistance, scholarships, and other aid; direct institutional subsidies; third-party awards; private-sector involvement; and administrative infrastructure.

The objectives are to establish uniform outcomes for all NASA MUREP awards and provide compact instruments for uniform collection of data keyed to those outcomes. This process reduces the collection of data to the minimal amounts possible, emphasizes outcomes and is applicable to any common set of awards. The data collected can be aggregated both horizontally and longitudinally, permits adjustable benchmarking standards to be applied, and is collected electronically over the World Wide Web. A single annual collection of data is used to provide the information necessary for comparative and correlational analysis across

research or education projects, and annual MUREP performance reports, including those required by the White House Initiative Offices on HBCU's, Educational Excellence for Hispanic Americans, and Tribal Colleges and Universities. Based on prior years' evaluation results, the following uniform measures of performance have been established for OEOP MUREP research and education awards.

RESEARCH SCHEDULE & OUTPUTS (for URC's, IRA's, PI's, and Partnership (Research) Awards)

- Participants – number of students, faculty, post-doctoral researchers, research associates supported
- Student Outcomes – number of degrees awarded, post-graduation plans
- Research Outcomes – number of referred papers, technical presentations, patents, commercial products, and amount of research funds leveraged from other sources

EDUCATION AND TRAINING SCHEDULE & OUTPUTS (for MSE's and Partnership (Education) Awards)

- Participants - number of students, teachers supported
 - High School Student Outcomes - enrollment in Mathematics, Science, Education and Technology (MSET) courses, graduation, enrollment in college, and selection of MSET majors
- Bridge Student Outcomes - completed freshman year in college
- Undergraduate & Graduate Student Outcomes - number of degrees awarded, post-graduation plans
- Teacher Outcomes - number of received certificates

IRA (NRTS) additional metrics are designed to capture the technology and education focus of these awards. Specific metrics will include:

- The number of HBCU's, OMU's, and public schools connected to the Internet
 - The number of faculty, teachers and students trained to utilize the Internet to enhance research and educational outcomes

Continuous assessment of performance, through annual evaluations of individual awards and the collection of uniform outcomes across all research and education programs, will clearly indicate the impact of NASA MUREP on the scientific and technological base for NASA and the Nation, while minimizing the reporting burden on award recipients.

ACCOMPLISHMENTS AND PLANS

NASA's investment in MI's for FY 1998 achieved the following:

1. Funding reached 45 states, the District of Columbia, Puerto Rico, and the Virgin Islands.
2. The number of competitively peer-reviewed and merit selected MUREP awards totaled 59 in FY 1998.
 - 3. 42 HBCU's were the direct recipients of 169 research and education awards valued at \$31.3M. 30 OMU's received 26 awards valued at \$11.4M. Other institutions of higher education and non-universities received \$12.1M in support of outreach activities to minorities and individuals with disabilities underrepresented in NASA career fields. These awards included:

- 72 awards to 20 HSI's at \$10.3M
- 10 awards to 8 Tribal Colleges and Universities at \$1.1M
- 88 awards to other institutions of higher learning
- 11 awards to non-universities such as the National Research Council, American Association for the Advancement of Science, American Society for Engineering Education, National Association for the Advancement of Equal Opportunity in Higher Education, etc.

Research Accomplishments included the following number of participants: 396 faculty members, 130 research associates, 35 postdoctoral fellows, 664 undergraduates, and 419 graduates. The MI's were able to leverage their NASA MUREP funding of \$31.2 million (including \$6.6 million for students) to an additional \$33.7million in research support, \$11.4 million from other NASA programs, and \$22.3 million from other agencies. Technology transfer activities reported included 23 patent awards, 28 patent applications, and 27 patent disclosures; and 37 commercial products being developed or marketed. A major goal of MUREP is to increase the number of socially and economically disadvantaged and disabled students receiving advanced degrees and entering into careers in NASA-related fields. Of the 1,084 students involved in these research projects during the reporting period, 664 (61%) participated at the bachelor's-degree level, 299 (28%) participated at the master's-degree level, and 120 (11 percent) participated at the doctoral-degree level. During the reporting period, 363 students obtained degrees: 220 bachelor's degrees; 116 master's degrees; and 27 doctoral degrees.

In Education and Training area, NASA MUREP grantees were asked to respond to the above-listed measures of performance via the web to provide a clearer, more concise reporting mechanism across all of the grants. The Uniform Outcomes Report also was designed to avoid duplication of reporting requirements by serving as the grantees' annual performance report. The outcomes reported for FY 1998 (reporting period Academic Year 1997-98 and Summer 1998) show great achievements for underrepresented and under served students, teachers and faculty. There were 230 MUREP education and training projects conducted at Minority institutions. The programs included precollege and bridge programs, education partnerships with other universities, industry and nonprofit organizations, Network Resources Training Sites (NRTS), teacher training, and graduate and undergraduate programs. These programs reached a total of 46,638 participants, with the predominant number at the precollege level. The programs achieved major goals of heightening students' interest and awareness of career opportunities in MSET fields, and exposing students to the NASA mission, research and advanced technology through role models, mentors, and participation in research. Formats included Saturday Academies, after school classes, visits to NASA Centers and other scientific and technical industries, museums, hands-on science experiments and computer training. Many projects also included components in English, writing, public speaking, and data analysis with the goal toward developing a well-grounded student.

Grantees reported that 12,681 high school students participated in NASA programs and 6,512 high school students selected college preparatory MSET courses. There were 1,482 high school graduates and 237 bridge students (high school graduates) in NASA programs. One thousand thirty four students enrolled in college, and 345 selected MSET majors. There were 171 students who successfully completed their freshman year. For the teacher programs, 2,396 teachers participated and 206 teachers received certificates. For undergraduate student programs 4796 students participated, 145 received degrees, 43 are employed in a NASA-related field. There were 112 graduate students participating in graduate programs, 22 received degrees, and 31 became employed in a NASA-related field. There were 33 papers published, 15 of which were authored or co-authored by students. One hundred seventy nine presentations were given at NASA installations, and 213 presentations at national or international conferences.

During FY 1999, NASA MUREP will continue to focus on its goals and strategies to integrate mission-focused research, technology transfer, and education at HBCU's and OMU's. NASA will continue and expand partnership awards that leverage NASA's investment by encouraging collaboration among NASA, university researchers and educators, and the aerospace industry. Plans for new awards include new Individual Principal Investigator's Research awards and Math and Science awards. The financial investment of \$28.8M by NASA Strategic Enterprises is planned for FY 1999.

In FY 2000, as in FY 1999, NASA MUREP will continue to focus on its goals and strategies to integrate mission-focused research, technology transfer, and education at HBCU's and OMU's. NASA will emphasize partnership awards that leverage NASA's total research investment in higher education institutions and aerospace industry. NASA will continue to increase the number of solicited awards that are selected through the peer review award process. Plans for new awards categories are dependent upon the number of expiring awards. It is forecasted that expiring awards will provide opportunities for new Institutional Research Awards, Individual Principal Investigator's Research, Math and Science Education Partnership Awards. The Strategic Enterprises investment will remain \$28.8M. The technical involvement by NASA Strategic Enterprises research conducted by HBCU's and OMU's will continue.

BASIS OF FY 2000 FUNDING REQUIREMENT

HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
		(Thousands of Dollars)	
University Research Centers.....	200	--	--
Institutional Research Awards.....	--	1,000	3,200
Principal Investigator Awards.....	4,600	5,200	4,500
Math Science and Education Awards.....	16,200	14,500	18,500
Partnership Awards.....	<u>9,000</u>	<u>15,500</u>	<u>1,800</u>
 Total Minority Programs.....	 <u>30,000</u>	 <u>36,200</u>	 <u>28,000</u>
Enterprise Program Funding*.....	12,800	17,100	17,100
Total, Historically Black Colleges and Universities.....	<u>42,800</u>	<u>53,300</u>	<u>45,100</u>

* Represents funding included in Enterprise budget request in support of Minority University Programs

PROGRAM GOAL

NASA's HBCU program is responsive to Executive Order 12928, which require all Federal Agencies to strengthen the capacity of HBCU's to provide quality education and to participate in and benefit from federal programs. The primary goal of NASA's HBCU program is to enhance institutional infrastructure in NASA-related areas and to provide technical assistance to facilitate planning, development, and the use of new technologies that will ensure the long-term viability and educational outcomes of HBCU's in areas strategic to NASA's mission.

STRATEGY FOR ACHIEVING GOALS

HBCU's were involved in NASA's mission before humans set foot on the Moon in 1969. In 1980, President Jimmy Carter signed Executive Order 12232 that established a Federal program "...to strengthen and expand the capacity of HBCU's to provide quality education." Executive Orders issued by Presidents Ronald Reagan and George Bush strengthened this program. NASA's current initiatives for HBCU's are based upon two recent Executive Orders. Executive Order 12876, signed November 1, 1993, by President William J. Clinton, mandates that agencies ". Advance the development of human potential, to strengthen the capacity of HBCU's to participate in and benefit from federal programs to achieve an increase in the participation by HBCU's in federal programs." Executive Order 12928, signed February 16, 1994, by President Clinton directs Federal agencies to promote procurement with

“...Historically Black Colleges and Minority Institutions.” NASA employs a comprehensive strategy to accomplish the HBCU program goals. This approach is carried out through awards in five areas:

ACCOMPLISHMENTS AND PLANS

As a result of NASA's FY 1998 investment in HBCU's, 42 HBCU's were the recipient of 169 awards that reached more than 26,000 faculty, teachers and students. Specific accomplishments for each of the categories are as follows:

FY 1998 Accomplishments	University <u>Research</u> <u>Centers</u>	Principal <u>Investigators</u>	Partnership <u>Awards</u>
Research Population Supported:	<u>551</u>	<u>352</u>	<u>283</u>
Faculty Members	134	63	72
Research Associates	31	33	16
Postdoctoral Fellows	12	2	8
Bachelor-degree Level Students	211	183	135
Master's-degree Level Students	113	62	39
Doctoral-degree Level Students	50	9	13
Degrees Awarded:	<u>127</u>	<u>56</u>	<u>64</u>
Bachelor Degrees	78	30	49
Master's Degrees	40	20	14
Doctoral Degrees	9	6	1
% Socially/Economical Disadvantaged or Disabled	92%	80%	80%
Research Accomplishments:			
Refereed Papers or Book Chapters:			
Published	172	46	27
Student (Co) Authors to above	78	26	11
Accepted for Publication	79	23	14
Student (Co) Authors to above	34	27	11
Technical Presentations:			
Total Presentations	500	184	127
Presentations given by Students	152	52	25
Leverage Achieved (in \$M):			
Funding Provided by MUREP	\$13.0	\$3.8	\$3.5

Leverage from Other NASA Programs	\$4.9	\$1.2	\$0.5
Leverage from Other Agencies	\$9.0	\$3.2	\$2.1
Technology Transfer Activities:			
Patents disclosed, applied for, or awarded	3	23	11
Commercial products being developed/marketed	4	7	8
Grant Awards Reporting	14	58	24

The FY 2000 budget estimate includes funding to continue HBCU's involvement in all five award categories.

HBCU University Research Centers (URC) Awards

Eleven HBCU Research Centers were established by the Headquarters Office of Space Science (OSS); Office of Aero-Space Technology (OAST); Office of Space Flight (OSF); Office of Microgravity and Life Sciences (OMLS); Office of Earth Science (OES), and the Office of Equal Opportunity Programs (OEOP). Funding is provided in two stages, the amount depending on the universities' capabilities. In the first stage, more funding is provided to establish a research infrastructure capable of sustaining long-term success in their research and education efforts (up to \$2M per university). The funding is reduced in the second stage (not to exceed \$1M per university) to recognize and encourage the movement of the URC's towards self-sufficiency through other funding sources. In FY 2000 funding for the following HBCU URC's will continue to be provided by the Strategic Enterprises.

<u>University</u>	<u>Research Focus</u>	<u>Enterprises</u>	<u>Lead NASA Installation</u>
Clark Atlanta	High Performance Polymers & Composites Research	OAST	Glen Research Center
Fisk	Photonic Materials and Devices	OSS	Marshall Space Flight Center
Florida A&M	Nonlinear and Nonequilibrium Aeroscience	OAST	Langley Research Center
Hampton University	Optical Physics	OSS, OES	Langley Research Center
Howard University	Study of Terrestrial and Extraterrestrial Atmospheres	OSS, OES	Goddard Space Flight Center
North Carolina A&T State	Aerospace Research	OAST	Langley Research Center
Tuskegee University	Food and Environmental Systems for Human Exploration of Space	OAST	Johnson Space Center
Alabama A&M	Hydrology, Soil Climatology, and Remote Sensing	OES	Marshall Space Flight Center
Morehouse School of Medicine	Space Medicine and Life Sciences	OLMSA	Johnson Space Center
Prairie View A&M	Applied Radiation Research	OSF	Johnson Space Center
Tennessee State	Automated Space Science	OSS	Goddard Space Flight Center

HBCU Institutional Research Awards (IRA)

Five HBCU's received renewal awards in FY 1998 for IRA (NRTS) from the OES, OSS and OEOP. These lead NRTS are part of a network that encompasses seven regions that cover the 50 states, Puerto Rico and the Virgin Islands. A minimum of two faculty/teacher/student regional training workshops per institution were held this year. GSFC serve as the Lead Center for the IRA NRTS Program. The lead NRTS' universities are: Prairie View A&M, Elizabeth City State, Morgan State, South Carolina State, and Tennessee State.

In FY 2000, OES, OSS and OEOP will continue funding for the five HBCU IRA (NRTS) selected to bring advanced computer networking infrastructure and technologies to other institutions of higher education and schools with substantial enrollments of socially and economically disadvantaged and disabled students in their regions. These institutions are responsible for information dissemination sites, developing faculty and student network skills, and user working groups.

HBCU Principal Investigator (PI) Awards

The PI Awards for Research are composed of MUREP solicited (also known as Faculty Awards for Research or FAR) and unsolicited (or Other Research and Technology) awards. FAR grants provide for research and student support and exposure to the NASA peer review process to enable them to demonstrate creativity, productivity, and future promise in the transition toward achieving competitive awards in the Agency's mainstream research activities. The number of unsolicited awards depends on funding provided to MUREP, with the priority being on FAR awards.

The majority of HBCU research selected for funding is made through competitive peer review and merit selection processes to enhance opportunities for participation in the Agency's mainstream research capabilities are enhanced through interaction with NASA researchers and faculty. Additionally, the pool of socially and economically disadvantaged students with research experience and interest in pursuing advanced MSET degrees in the fields of science, engineering, and mathematics will increase through faculty support. In FY 2000, 10 second year FAR awards will be continued and 10 new FAR awards will be selected.

HBCU Math and Science Education Awards

During the FY 1998 reporting period (Academic Year 1997-98 and Summer 1998), 98 MUREP education and training projects were conducted at HBCU institutions. The programs included precollege and bridge programs, education partnerships with other universities, industry and nonprofit organizations, NRTS, teacher training, and graduate fellows and/or undergraduate programs. These programs reached a total of 24,512 participants, with the predominant number at the precollege level. The programs achieved major goals of heightening students' interest and awareness of career opportunities in MSET fields, and exposing students to the NASA mission, research and advanced technology through role models, mentors, and participation in research and other educational activities. The reported outcomes on the survey were as follows. Grantees reported 5,359 high school students in NASA programs and 3,002 high school students selected college preparatory MSET courses, 624 high school graduates, 452 enrolled in college, and 212 selected MSET majors. There were 836 high school graduates (bridge students) in

NASA programs and 117 students who successfully completed their freshman year. There were 1382 teachers in teacher programs and 90 teachers received certificates. For undergraduate student programs of 2745 students, 67 received degrees, 25 are continuing for the next degree, 27 are employed in a NASA-related field. There were 38 graduate students reported in the survey, 9 received degrees, and 2 employed in a NASA-related field. There were 14 papers published, 8 of which were authored or co-authored by students. Ninety-five students gave presentations at NASA Installations, and 74 students presented at a national/international conference.

In FY 2000, three third year and five second year MASTAP awards will be continued. Eleven third year and eleven second year PACE awards will be continued. Ten new HBCU MASTAP and/or PACE awards will be selected to replace expiring awards in FY 2000.

Additional funding of \$1.6M was included in the FY 1999 Appropriation bill for VA-HUD-Independent agencies for a grant to Morgan State University (MSU) for capital renovations and environmental remediation at the University's multipurpose facility to facilitate its effective use for the conduct of math and science education workshops to at-risks students in middle and high school. Once a proposal is received from MSU, NASA projects the award to be made to MSU by the beginning of the third quarter of FY 1999. As a result, funds will be available for this award through FY 2000.

HBCU Partnership Awards

In FY 1998, 45 Partnership Awards to HBCU in 14 states and the District of Columbia were continued. Four new Partnership Awards for the Integration of Research into Undergraduate Education (PAIR) were competitively awarded to HBCU's. In FY 1999, the Partnership Awards selected in FY 1997 will receive their last year funding, and the four PAIR selected for five year awards will receive second year funding. Expiring Partnership Awards recipients will have an opportunity to competitively apply for new funding under a NASA Research Announcement. All NASA Centers and Jet Propulsion Laboratory will accept proposals, conduct the review, recommend awards for selection, and continue to manage the Partnership Awards. In FY 2000, the newly selected Partnership Award recipients will receive second year funding, the PAIR third year funding, and two new PAIR awards will be made during FY 2000.

BASIS OF FY 2000 FUNDING REQUIREMENT

OTHER MINORITY UNIVERSITIES

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
		(Thousands of Dollars)	
Institutional Research Awards.....	2,000	500	1,500
Principal Investigator Awards.....	2,500	3,100	3,600
Math Science and Education Awards.....	15,000	18,500	11,700
Partnership Awards.....	<u>3,700</u>	<u>8,600</u>	<u>1,100</u>
 Total Minority Programs	<u>23,200</u>	<u>30,700</u>	<u>17,900</u>
Enterprise Program Funding *	8,000	11,700	11,700
Total, Other Minority Universities	<u>31,200</u>	<u>42,400</u>	<u>29,600</u>

*Represents funding included in Enterprise budget request in support of Minority University Programs

PROGRAM GOAL

The primary goal of NASA's OMU program is to increase the opportunities for Hispanic-Serving Institutions (HSI's), Tribal Colleges and Universities (TCU) and educational organizations serving substantial numbers of people with disabilities to participate in and benefit from NASA's research and education programs.

STRATEGY FOR ACHIEVING GOALS

NASA established the OMU program per P. L. 98-371, House Report 98-803, and Senate Report 98-506) to "...review institutions of higher learning having significant minority enrollments to find ways to build closer relations with such schools, meet NASA's research objectives and increase the number of individuals from underrepresented groups in the pool of graduate researchers...build a closer relationship with institutions serving significant numbers of minorities. In addition, Executive Order 12900 (February 22, 1994) mandated that agencies increase Hispanic American participation in Federal education programs where Hispanic Americans currently are under served, Executive Order 12928 (September 16, 1994) directed Federal agencies to promote procurement with "...Historically Black Colleges and Minority Institutions", and P.L. 103-327 directed the establishment of URC's at the HSI's. Executive Order 13021 (October 19, 1996) directed Federal agencies and departments to strengthen their relationships with Tribal Colleges and Universities. In response, NASA is developing a 5-year plan of action and will submit annual accomplishment reports when the White House Initiative Office for Tribal Colleges is established. Present awards to TCU's are encouraged within the five programmatic awards.

Although similar to the HBCU Program strategies, because of the differences in the evolution of minority institutions and the particularities of Federal mandates for HBCU's and Hispanic Americans, NASA's approach and implementation plan for OMUs have been adjusted to incorporate these factors. For example, the Federal mandate for Hispanic Americans directs Federal agencies to "...improve educational outcomes for Hispanic Americans participating in Federal education programs...". As a result, the Agency has placed greater emphasis on mathematics and science awards than on institutional research awards.

ACCOMPLISHMENTS AND PLANS

As a result of NASA's FY 1998 investment in OMU's, 30 OMU's were the recipient of 84 awards which reached more than 23,000 faculty, teachers and students. Specific accomplishments for each of the categories are as follows:

FY 1998 Accomplishments	<u>University Research Centers</u>	<u>Institutional Research Awards</u>	<u>Principal Investigators</u>	<u>Partnership Awards</u>
Research Population Supported:	<u>152</u>	<u>165</u>	<u>136</u>	<u>45</u>
Faculty Members	51	27	31	18
Research Associates	14	28	5	3
Postdoctoral Fellows	3	5	4	1
Bachelor-degree Level Students	44	64	54	13
Master's-degree Level Students	31	16	31	7
Doctoral-degree Level Students	9	25	11	3
Degrees Awarded:	<u>55</u>	<u>17</u>	<u>28</u>	<u>7</u>
Bachelor Degrees	25	9	15	5
Master's Degrees	26	4	11	1
Doctoral Degrees	4	4	2	1
% Socially/Economical Disadvantaged or Disabled	82%	82%	82%	86%
Research Accomplishments:				
Refereed Papers or Book Chapters:				
Published	180	106	15	8
Student (Co) Authors to above	115	62	12	15
Accepted for Publication	84	52	4	7
Student (Co) Authors to above	57	42	5	12
Technical Presentations:			48	
Total Presentations	312	139	14	23
Presentations given by Students	148	77	10	2

Leverage Achieved (in \$M):

Funding Provided by MUREP	\$4.7	\$4.1	\$1.5	\$0.7
Leverage from Other NASA Programs	\$3.8	\$1.0		
Leverage from Other Agencies	\$6.4	\$0.7	\$0.4	\$0.5

Technology Transfer Activities:

Patents disclosed, applied for, or awarded	3	36	2	
Commercial products being developed or marketed	4	13	1	

Grant Awards Reporting	3	5	27	6
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Three **OMU University Research Centers Awards** were established by the Headquarters Office of Space Science (OSS); Office of Aero Space Technology (OAST); Office of Space Flight (OSF); Office of Earth Science (OES), and the Office of Equal Opportunity Programs (OEOP) to achieve a broad-based, competitive aerospace research capability among the Nation's OMU's. These universities will be submitting proposals in FY 1999 that will be evaluated to determine if funding will be continued.

<u>University</u>	<u>Research Focus</u>	<u>Enterprises</u>	<u>Lead NASA Installation</u>
New Mexico	Autonomous Control Engineering	OAST	Lewis Research Center
Texas at El Paso	Pan American Center for Earth and Environmental Studies	OES	Marshall Space Flight Center
Puerto Rico at Mayagüez	Tropical Center for Earth and Space Studies	OSS, OES	Langley Research Center

OMU Institutional Research Awards (IRA) The IRA (Research) goals include: (1) strengthening and improving core research areas of significance to the NASA mission; (2) increasing the number of students who are U.S. citizens conducting space research and working in NASA-related disciplines; (3) strengthening the research environment of eligible institutions and the capability of individuals by supporting the institutional infrastructure (through the acquisition of research equipment), faculty research, disadvantaged U.S. citizens who are undergraduate and graduate student researchers; and (4) transferring technology to the market place and to minority communities. To achieve these objectives, an agency wide TRC is assigned to each of the selected IRA (Research) award recipients and are responsible for providing technical guidance. NASA promotes collaboration between its funded IRA institutions, the Centers, JPL, and with entities outside of NASA. Institutions are encouraged to seek funding through NASA's traditional opportunities, as well as other government agencies and private sources to promote future sustainability. IRA awards require substantial undergraduate and graduate student involvement in research projects.

IRA (Research)

<u>University</u>	<u>Research Focus</u>	<u>Enterprises</u>	<u>Lead NASA Installation</u>
California State-Los Angeles	The Use of Decentralized Control in Design of a Large Segmented Space Reflector	OSS	Jet Propulsion Laboratory
Florida International	High Performance Database Management with Application to Earth Sciences	OES	Goddard Space Flight Center
Puerto Rico at Rio Piedras	Land Management in the Tropics and Its Effects on the Global Environment	OES	Marshall Space Flight Center
City College of New York	Tunable Solid State Laser and Optical Imaging	OAST	Langley Research Center
New Mexico Highlands	Alliance for Nonlinear Optics	OAST	Marshall Space Flight Center

IRA (NRTS)

<u>University</u>	<u>Research Focus</u>	<u>Enterprises</u>	<u>Lead NASA Installation</u>
City College of New York	Urban Collaboration for Network Connectivity and Internet Access	OSS, OES	Goddard Space Flight Center
Texas at El Paso	Network Resources Training Sites	OSS	Goddard Space Flight Center

OMU Principal Investigator (PI) Awards

In FY 1998, funding for 7 third-year, 4 second-year and 10 new FAR awards will be provided. In FY 1999, funding for 4 third-year, 10 second-year, and 10 new FAR awards will be provided, as well as funding for individual PI awards. In FY 2000, 10 third-year, 10 second year and 10 new FAR awards will be funded.

Through the competitive process for awards, opportunities for participation in the Agency's mainstream research will expand as recipients' research capabilities are enhanced through interaction with NASA researchers and faculty. Additionally, the pool of disadvantaged students with research experience and interest in pursuing advanced degrees in the fields of science, engineering, and mathematics will increase through faculty support.

OMU Math and Science Education Awards

The Math and Science Education Awards are composed of unsolicited awards and awards made based on solicitations. Primary funding supports the following four focus areas: undergraduate awards; graduate awards; precollege awards; and teacher enhancement and preparation awards.

For the FY 1998 reporting period (Academic Year 1997-98 and Summer 1998), 132 MUREP education and training projects were conducted at OMU institutions. The institutions conducted precollege and bridge programs, education partnerships with other

universities and industry, NRTS, teacher training, and graduate and undergraduate programs. These programs reached a total of 22,126 participants, predominantly at the precollege level and achieved major goals of heightening students' interest and awareness of career opportunities in MSET fields, and exposing students to the NASA mission, research and advanced technology through role models, mentors, and participation in research and other educational activities. Also in FY 1998 NASA continued a very meaningful relationship with the Hispanic Association of Colleges and Universities (HACU) through Proyecto Access, a consortium through which HACU links seven HSI's together to conduct 8-week summer programs.

During the FY 1998 reporting period, grantees reported 7,322 high school students in NASA programs and 3,510 high school students selected college preparatory MSET courses, 858 high school graduates, 582 enrolled in college, and 133 selected MSET majors. There were 130 high school graduates (bridge students) in NASA programs and 54 students successfully completed their freshman year. There were 1014 teachers in teacher programs and 116 teachers received certificates. There were 2051 undergraduate students, of which 78 received undergraduate degrees; and 18 are employed in a NASA-related field. There were 74 graduate participants, 13 who received graduate degrees, and 29 employed in a NASA field. There were 19 papers published, 7 of which were authored or co-authored by students. Eighty-four students gave presentations at NASA Installations and 139 students gave presentations at national/international conferences.

In FY 1998, the five OMU MASTAP's continue to contribute to the National Education Goals by enhancing the ability of pre-service and in-service teachers to teach mathematics and science in schools under served by NASA. This has been achieved through the development of special courses, curriculums, instructional models, publications, presentation of academic papers, teacher certifications.

Pre-service teachers have gained valuable classroom experience while at the same time providing extra attention to students in schools with large numbers of disadvantaged students. In the process, several teachers completed Masters Degrees. These programs have had a positive impact on both the universities that implement them and on the school districts with which they have partnered. The program is currently being reviewed with a goal to multiply the positive results of the implemented programs. Effective and innovative instructional materials, curriculums and models developed by MASTAP programs will be distributed to a broad audience.

In FY 2000, one third year and four second year MASTAP awards will be continued. Five third year and five second year PACE awards will be continued. Ten new OMU MASTAP and/or PACE awards will be selected to replace expiring awards in FY 2000.

Additional funding of \$10M was included in the FY 1999 Appropriation Bill for VA-HUD-Independent agencies for the Science, Engineering, Mathematics Aerospace Academy (SEMAA) to replicate the training provided to other sites. The three components are as follows. Living In Space for the K-4th graders has classes for both students and parents to institutionalize math and science in the home. Exploring the Solar System for 5th-8th graders increases their awareness of MSET skills and the use of laboratory equipment. Discovering Aeronautics for 9th - 12th graders was developed to be used with GRC or the Mobile Aeronautics Education Lab when available. FY 1999 funds will continue the program through FY 2000.

OMU Partnership Awards

In FY 1998, 22 Partnership Awards to OMU's in 8 states and Puerto Rico were continued. Three new Partnership Awards for the Integration of Research into Undergraduate Education (PAIR) were competitively awarded to OMU's. In FY 1999, Partnership Awards selected in FY 1997 will receive their last year funding, and the three PAIR selected for five year awards will receive second year funding. Expiring Partnership Awards will have an opportunity to competitively apply for new funding under a NASA Research Announcement. All NASA Centers and Jet Propulsion Laboratory will accept proposals, conduct the review, recommend awards for selection, and continue to manage the Partnership Awards. In FY 2000, the newly selected Partnership Award recipients will receive second year funding, the PAIR third year funding, and two new PAIR awards will be made during FY 2000.